

ANTENNA FOR PORTABLE COMPUTERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to portable computers and, in particular, to antennas for portable computers.

2. Description of Related Art

Various communication systems are used to allow computers to communicate and exchange data and other types of information. For example, computers are often linked by various networks, including Local Area Networks (LAN), Internet, Ethernet and conventional telephone networks. These known communication systems, however, usually require the computer to be physically connected to telephone lines, modems or specialized wiring. In some locations, however, it is difficult if not impossible to be physically connected to the communication system. Additionally, these known systems generally cannot be used if the user is traveling or moving to different locations.

It is also known to use cellular telephone and wireless systems to connect computers to a communication system. Cellular telephone systems are particularly effective in allowing computers to communicate because the computer does not have to be connected to an existing telephone line. In addition, cellular telephone systems are very useful in connection with portable computers because the cellular communication circuitry can be miniaturized and provided as a component of the computer.

Antennas used with cellular communication systems generally include a number of antenna elements, each including a radiating element which is equal in length to some fraction of the wavelength desired to be transmitted or received. In order to increase the efficiency of communication, these known antennas must include elements which are separated by a minimum distance and these elements are preferably orientated normal to each other to provide the necessary separation and spatial diversity.

Conventional antennas used to connect a computer to a wireless communication system or cellular telephone are typically placed externally of the computer because of the noise, interference, obstruction and shielding caused by the various components of the computer. In particular, conventional antennas do not function correctly if they are obstructed or shielded by the housing or other structures of the computer.

Conventional antennas are also generally rigid and they protrude a relatively long distance from the body of the computer. These protruding antennas are often large, unwieldy, aesthetically displeasing and they make the computer difficult to move and transport. In addition, these antennas are often bent, broken, knocked out of alignment or otherwise damaged because they can easily catch or strike foreign objects such as people, walls, doors, etc. Further, these known antennas require a large support structure to secure the antenna to the housing of the computer and this support structure requires a considerable amount of space inside the body of the computer. This space is very valuable, especially in small, portable computers. Additionally, the support structure is often damaged when the antenna is accidentally moved.

It is known that the repair and replacement of conventional antennas and the associated support structure is difficult and costly. In fact, the entire antenna assembly is often removed and replaced instead of attempting to repair a portion of the antenna or support structure. Thus, the repair

and replacement of the antenna and/or antenna support structure is expensive and time consuming.

In order to alleviate these problems, known antennas are often removed before the computer is moved or transported. Additionally, known antennas must often be removed before the computer can be inserted into its carrying case. Disadvantageously, this requires additional time and resources to remove and reattach the antenna each time the computer is moved. Additionally, the antenna is often misplaced, lost or damaged when it is detached from the computer. Further, because the user often does not want to take the time and effort to remove the antenna, the computer is moved with the antenna still attached to the computer and this frequently results in the antenna being damaged or broken.

It is known to use a telescoping antenna in an attempt to minimize these problems. For example, U.S. Pat. No. 5,684, 672 issued to Karidis, et al. discloses a laptop computer with an integrated multi-mode antenna. The telescoping antenna is integrated into the cover or display portion of the laptop and it outwardly extends from the display portion for use. The telescoping antenna is then retracted into the display portion when it is not in use. A coaxial cable connects the antenna to the base of the computer. In particular, the coaxial cable connects the antenna to a radio frequency (RF) adaptor card inserted into a Personal Computer Memory Card International Adapter (PCMCIA) slot in the base of the computer. Disadvantageously, the coaxial cable or connector disclosed in the Karidis patent protrudes outwardly from the base of the computer and the user must manually extend and retract the antenna. Additionally, it is well known that an antenna should be placed in a vertical position to obtain the optimum signal strength. However, because the antenna disclosed in the Karidis patent is attached to the display portion of the computer and the antenna is positioned parallel to the display screen, the display screen must be vertically positioned in order for the antenna to obtain the best possible signal. The vertical positioning of the screen, however, may not be the preferred viewing angle of the screen for the computer user. Further, this and other conventional antennas have limited connectivity when the display screen is in the closed position because the antenna extends in a horizontal plane and the housing of the computer may obstruct or shield the antenna.

It is also known to connect an antenna directly to a PCMCIA card. When this type of card is inserted into the PCMCIA slot in the body of the computer, the antenna extends outwardly from the body of the computer. The PCMCIA card and the computer itself, however, are easily damaged by accidental contact with the outwardly extending antenna. Thus, users of PCMCIA cards with antennas must be extremely careful when using the computer in order to avoid damage to the card and/or computer. Additionally, these PCMCIA cards with antennas generally must be removed from the PCMCIA slot in the computer whenever it is desired to store or move the computer. This requires additional time and effort by the user, and the PCMCIA card and antenna may be lost, damaged or misplaced by the user when it is not connected to the computer.

In addition, the PCMCIA card with the attached antenna often receives a degraded or impaired signal because the antenna is frequently obstructed by the computer housing and/or shadowed by the ground plane of the display. Further, the antennas of these types of PCMCIA cards typically have a ferrite core which is very brittle and it is easily broken. If the ferrite core is broken, PCMCIA card assembly or the antenna must be repaired or replaced.